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Introduction*

Arianna Betti & Willem R. De Jong

Forthcoming in *Synthese*, Special Issue: *The Classical Model of Science I: A Millennia-Old Model of Scientific Rationality*. Guest Editors: Arianna Betti & Willem R. De Jong

This special issue of *Synthese*, “The Classical Model of Science I: a Millennia-Old Model of Scientific Rationality”, centres on the role, the significance and the impact of the traditional axiomatic ideal of scientific knowledge in the history of philosophy from Aristotle to the 20th century. More specifically, the papers collected here investigate the relation between traditional axiomatics and a number of issues in the development of logic, mathematics, methodology and philosophy of science in Aristotle, Proclus, the 17th century, Kant, Bolzano, Frege and Leśniewski. The general idea shared by all contributions in this issue is that the axiomatic ideal in question can be systematized and turned into an interpretive framework, a ‘Classical Model of Science’, and that such a framework sheds new light on traditional debates, and allows us to reinterpret them accordingly.

In “The Classical Model of Science: A millennia-old model of scientific rationality” we set up the Classical Model of Science as a cluster of seven conditions which systematizes ideal standards of scientific rationality at least as old as Aristotle’s *Analytica Posteriora*. This cluster, we claim, sums up the core of what a proper science should look like according to that ideal, and it remained remarkably constant for more than two millennia. The terminology we introduce in this first paper, where for example we often speak of some conditions of the Model as numbered ‘Postulates’, and which regard meaningfulness, economy, definability, provability, truth, necessity, knowability of propositions and terms (or concepts) of a science, is variously taken up by the papers which follow, some of which are strongly interrelated.

By focusing on some conditions of the Model, i.e., that in a science *S* there is a number of fundamental concepts (2a), that all propositions of *S* are necessary in some sense (5), and that the concepts and propositions are adequately known (7), Marije Martijn shows in “Proclus on the order of philosophy of nature” that Proclus adopts a version of the Classical Model of Science adapted to his Neoplatonic metaphysics and uses it to secure a firm foundation for philosophy of nature, that is, to show that philosophy of nature is a proper science. As Martijn points out, this is a rather non-Platonic endeavor, in which Proclus’ scientific method shows its profound debts to Aristotelian methodology.

Aspects of Proclus’ thought are also investigated in Paola Cantù’s paper, “Aristotle’s prohibition rule on kind-crossing and the definition of mathematics as a science of quantities”. Cantù presents a critical assessment of condition 1 of the Model, the Domain Postulate, according to which propositions and concepts of a proper science concern a *specific set of objects* or are about a *certain domain of being(s)*, by comparing the latter with the Aristotelian prohibition rule on kind-crossing. She shows the usefulness of

Aristotle's rule as interpretive tool in the history of the development of mathematics into a general science of quantities from Proclus' commentary to Euclid's first book of *Elements* to the works of Stevin, Wallis, Viète and Descartes through the sixteenth century translations of Euclid's work into Latin. Cantù argues among other things that only by supplementing the Model with the requirement that the domain of a science be as broad as possible are we able to detect substantive and interesting differences between conceptions of mathematics in the period at issue.

In "The analytic-synthetic distinction and the Classical Model of Science: Kant, Bolzano and Frege" Willem de Jong shows that Kant, Bolzano and Frege develop their own versions of the distinction between analytic and synthetic judgments or propositions within the Classical Model of Science. The outcome of the paper is that Frege takes logic to be an analytic science, while Bolzano takes it to be synthetic. And whereas common lore has it that logic is analytic according to Kant, what Kant calls logic can be qualified neither as analytic nor as synthetic, since he does not conceive of (general) logic as a Classical Science properly speaking.

Bolzano's and Frege's views on the methodology of deductive sciences are taken up again by Sandra Lapointe and Tapio Korte. Lapointe's "Bolzano, *a priori* knowledge, and the Classical Model of Science" presents and discusses Bolzano's views on grounding, *a priori* knowledge and implicit definition against the background of the Model. She explains that Bolzano's peculiar understanding of analyticity and the related notion of *Ableitbarkeit* might lead one to believe that Bolzano lacks a significant account of *a priori* knowledge. The paper shows that Bolzano's account of grounding and deductive knowledge is founded on an axiomatic understanding of deductive systems which, against Kant, rely on purely logical means. Moreover, it elucidates how Bolzano's account of conditions 6 and 7 of the Model, that is, what it means for propositions and terms of an *a priori* deductive science to be known (adequately), is related to his account of demonstration (condition 3b, the Proof Postulate).

Korte's "Frege's *Begriffsschrift* as a *lingua characteristica*" suggests an answer to the question of what Frege means when he argues that his *Begriffsschrift* is not only a logical calculus (*calculus ratiocinator*), but also a real *lingua characteristica* in Leibniz's sense. The answer is that presenting logic as a classical science as Frege does requires a real language to guarantee that expressions express content and that sentential expressions are capable of being true or false (cf. condition 4 of the Model, the Truth Postulate, which requires the propositions of a science to be true). Moreover, what makes the *Begriffsschrift* special is that it uses only grammatical or *syncategorematic* expressions and thus offers Frege the medium with which to show the analyticity of the theorems of arithmetic.

In "Leśniewski's *Characteristica Universalis*" Arianna Betti maintains that there is a strong methodological motivation why Lesniewski's logical systems deviate from standard logic in some basic conceptual and aesthetic features, namely that they were built in the spirit of a *characteristica universalis* following the conditions of the Classical Model of Science to an astounding degree. The paper gives an overview of the architecture of Leśniewski's systems and of their fundamental characteristics, and suggests among other things that the aesthetic constraints Leśniewski put on axioms and primitive terms have epistemological relevance.

The publication of this special issue concludes the first part of a project on the Classical Model of Science funded by the Netherlands Organisation for Scientific Research (project 275-80-001). The project started in November 2003 with a colloquium in Amsterdam on the analytic/synthetic distinction, where the first versions of De Jong's and Lapointe's papers were presented, followed by a symposium on science in Aristotelian perspective in the summer of 2004 in Turku, where the ancestors of the papers by Betti, Korte and Martijn were read. Our joint paper has been written for this issue and first discussed at a closed workshop in Amsterdam in June 2005 where the revised versions of all papers just mentioned were commented upon, with the aim of giving the collection maximum focus and coherence. In January 2007 we organised a conference in Amsterdam on the same topic with an open call for papers, where a version of the paper by Paola Cantù was presented. A second special issue ("The Classical Model of Science II - The Axiomatic Method, the Order of Concepts and the Disposition of Sciences") collecting a small selection of papers read at the conference and concluding the second part of the overall project is in the making. The paper by Cantù has been included in this first issue not only in view of its immediate bearing on our systematisation of the Model but also because it provides an enlightening historical connection from Proclus to the Modern Era.

We wish to thank Hein van den Berg for his careful job as minute taker during the closed workshop, Jan Willem Wieland for editorial assistance on the final versions, Donald Morton, Tony Tol and Trevor Perri for saving us from ugly mistakes and crooked sentences (if any remain, it's our fault), Owen LeBlanc, Wouter Goris, Katarzyna Kijania-Placek, Peter Simons, Göran Sundholm, the participants of the research group *Epistemology and Ontology* of the VU University Amsterdam for discussion and critical comments on previous versions of our papers. And thanks to Heli, Eino, Väinö and Niilo Korte, Bjørn Jespersen and Joke Mevius for having improved our lives at several junctures and especially on a mild summer evening of 2005.

Finally, thanks to Jan Woleński, and to the editor-in-chief of *Synthese*, John Symons, for having believed in this project and for supporting it by hosting both special issues in the journal series.

Amsterdam, 12 april 2008

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